In particular, the vacuum cleaner A' includes a modified cyclonic airflow dust and dirt separating region G'. As with the vacuum cleaner A, the cyclonic airflow region G' includes a cyclonic airflow chamber **54'** defined by an upper, fixed housing member **50*a'*** and a lower dirt cup or container **52'** which is pivotally and releasably connected to the upper housing B' of the vacuum cleaner via a hinge assembly **90'**. With reference now to FIG. **19**, the dirt cup **52'** includes a main filter support such as a post, stem, or like structure **150** extending upwardly from a floor or base **152** thereof. The post **150** is positioned in a central region of the cyclonic airflow chamber **54'**. A hollow cylindrical main filter element K is positioned over the main filter support **150**.

The filter element K is engaged in an interference fit with vanes **154** and a disc-like plateau **156** located on the floor **152** of the filter support so that the filter is releasably, yet securely, retained in its operative position as shown herein, even when the dirt cup **52'** is removed from the vacuum cleaner and inverted for purposes of emptying the contents thereof. A filter locking means **158**, accommodating a gasket **159**, is provided along the uppermost edge of the main filter element K. The main filter element K extends upwardly from the dirt cup floor **152** to a level approximately equal to an upper edge **100'** of the dirt cup **52'**. Most preferably, as shown herein, the uppermost edge of the main filter element K is also sloped in the same manner as is the dirt cup upper edge **100'**. Over the entire height of the dirt cup **52'**, an annular cyclonic airflow passage is defined between the main filter support and the dirt cup **52'**.

It should be apparent from a comparison of FIGS. **19** and **15** that the base **152** serves as the base of the dirt cup **52'**. To this end, the base **152** is suitably secured by conventional means to the side walls forming the dirt cup.

The main filter element K preferably comprises the same filter media as the filters H,H'. As shown herein, the filter element K is purely cylindrical in shape, but those skilled in the art will recognize that the filter element K may also be formed with a convoluted or other irregular shape to increase its surface area and efficiency.

Referring now also to FIGS. **16–18**, the upper housing member **50*a'*** includes an upper conduit **160** depending centrally from a top wall **162**. The upper conduit **160** is preferably a hollow cylindrical member with a passage **164** extending therethrough. The passage **164** is in fluid communication with the suction airstream outlet passage **60'** through which the suction airflow J' exits the cyclonic airflow chamber **54'**. The upper conduit **160** projects downwardly from the top wall **162** so that the lowermost edge **166** thereof is approximately equal to the level of the lower edge **102'** of the conduit member **50*a'***. Also, the lower edge **166** is sloped in a manner that corresponds to the slope of the housing member lower edge **102'**. The upper conduit **160** is connected to the upper housing member **50*a'*** by any suitable means such as fasteners engaged in aligned bores **168*a*,168*b*** (FIG. **16**) respectively formed in the housing member **50*a'*** and conduit **160**. As mentioned, the gasket **159** is provided along the joint between the lowermost edge **166** of the upper conduit **160** and the upper edge of the filter K.

With reference now specifically to FIG. **18**, an open or airstream permeable auxiliary filter support grid or framework **170** is provided, preferably in the region of the lower edge **166** of the conduit **160**. The open filter support **170** provides a backing member for a foam, paper, or similar conventional auxiliary filter element **174** that removes any residual dust and dirt from the suction airstream J' prior to its exit of the cyclonic airflow chamber **54'** through the outlet passages **164** and **60'**. In case there is a break in the seal between the filter K and the conduit **160**, the auxiliary filter **174** will prevent dirt or dust from being sucked into the motor of the vacuum cleaner. One or more tabs or teeth **176** project radially inwardly from the conduit **160** in the region of the framework **170** to engage the auxiliary filter element **174** so that the filter element is secured adjacent the framework **170** and will not be dislodged from its operative position by the force of gravity

As is most readily apparent in FIG **15**, the main filter element K and the upper conduit **160** together define a cylindrical column extending through the center of the cyclonic airflow chamber **54'** between the floor **152** and top wall **162**. This preferred cylindrical column shape also results from the filter element K and the upper conduit **160** having substantially the same outside diameter.

As the suction airstream J' enters the cyclonic chamber **54'** through the tangential inlet **80'**, it travels downwardly in a cyclonic fashion so that dust and dirt entrained in the suction airstream are separated therefrom and collected in the dirt cup **52'** (as indicated at L). The suction airstream J' then passes through the main filter element K to remove residual contaminants therefrom, and moves upwardly through the main filter element K, through the auxiliary filter element **174**, and into the outlet passage **164**. The airstream J' is prevented from bypassing the main filter element K by the gasket **156** positioned between the filter element K and the conduit **160**. The airstream J' then exits the cyclonic airflow chamber **54'** through the outlet passage **60'** and continues as described in relation to the vacuum cleaner A.

The position of the main filter element K, extending upwardly from the floor **152**, is highly desirable given that, as dust and dirt L are collected, at least a portion M of the suction airstream passes through the accumulated dust and dirt L. The accumulation of dust and dirt L seems to act as another filter element which filters more dust and dirt from the airstream M. Also, the flow of the suction airstream M downwardly through the accumulated dust and dirt L acts to compact the dust and dirt L downwardly toward the floor **152** so that the capacity of the dirt cup **52'** is efficiently utilized to extend the time before the dirt cup **52'** must be emptied.

The invention has been described with reference to the preferred embodiments. Obviously, modifications and alterations will occur to others upon reading and understanding the preceding detailed description. It is intended that the invention be construed as including all such modifications and alterations insofar as they come within the scope of the appended claims or the equivalents thereof.

Having thus described the preferred embodiments, the invention is now claimed to be:

1. A vacuum cleaner comprising:

a housing having a cyclonic airflow chamber for separating contaminants from a suction airstream, said housing including a floor, a top wall, a suction airstream inlet, and a suction airstream outlet, said airstream inlet and said airstream outlet being in fluid communication with said cyclonic airflow chamber;

a suction opening defined on said housing, said suction opening being fluidically connected with said airstream inlet;

an airstream suction source located on said housing, said suction source having an inlet fluidically connected to said airstream outlet and a suction source exhaust outlet, said suction source selectively establishing and maintaining a suction airstream from said suction opening to said suction source exhaust outlet;

a main filter support extending upwardly from the floor of the housing for releasably securing a main filter element centrally in said cyclonic airflow chamber;

a main filter element secured to said main filter support; and,

a dirt cup selectively positioned in said housing, said main filter element being positioned in said dirt cup.

2. The vacuum cleaner of claim 1 further comprising an upper conduit depending from said top wall and including an outlet passage therethrough in communication with the suction airstream outlet of said housing, said upper conduit including a lower edge adapted for sealingly engaging the main filter element so that said upper conduit and said main filter element together define a column extending between said floor and said top wall of said housing, whereby a suction airstream passing through said cyclonic airflow chamber from said suction airstream inlet to said suction airstream outlet passes through the main filter element, into said upper conduit, and exits said chamber through said suction airstream outlet.

3. The vacuum cleaner as set forth in claim 1 wherein said main filter element comprises high-density polyethylene porous filter media having pores with an average pore size of approximately 45 μm to approximately 90 μm.

4. The vacuum cleaner as set forth in claim 1 wherein said housing is defined by an upper housing member, wherein said upper housing member includes said top wall and an upper conduit depending from said top wall, and said dirt cup.

5. The vacuum cleaner of claim 4 wherein said dirt cup is pivotable between a closed, operative position and an open position, said dirt cup including said floor, said filter element extending upwardly from the floor and including an upper edge at a level substantially equal to an upper edge of the dirt cup, and said upper conduit depending downwardly and including a lower edge at a level substantially equal to the upper edge of said dirt cup, said vacuum cleaner further comprising a gasket disposed between said filter element upper edge and said lower edge of said upper conduit so that said main filter element and said lower edge of the upper conduit sealingly mate in an airtight manner when said dirt cup is in the closed, operative position, wherein said upper edge of said dirt cup is defined by an inclined edge such that when said dirt cup is pivoted fully into the open position, the inclined upper edge is located in a substantially horizontal plane to inhibit spillage of the separated dirt and dust.

6. The vacuum cleaner as set forth in claim 2 further comprising

an auxiliary filter element positioned in said upper conduit, said auxiliary filter element being so positioned that airflow exiting said cyclonic airflow chamber through said upper conduit passes therethrough and is filtered of residual dust and dirt; and,

an auxiliary filter support framework extending across an outlet passage defined in said upper conduit for supporting said auxiliary filter element in a blocking relationship relative to said outlet passage of said upper conduit.

7. The vacuum cleaner as set forth in claim 1 further comprising a final filter assembly positioned on the vacuum cleaner, said final filter assembly being in fluid communication with said suction source exhaust outlet for filtering said suction airstream exhausted from said suction source exhaust outlet and for discharging said suction airstream into the atmosphere.

8. The vacuum cleaner as set forth in claim 7 wherein said final filter assembly comprises a high efficiency particulate arrest (HEPA) filter media.

9. An upright vacuum cleaner comprising:

an upright housing section including a handle;

a nozzle base section hingedly interconnected with the upright housing section, said nozzle base section including a main suction opening formed in an underside thereof;

a cyclonic airflow chamber defined in said upright housing section for separating dust and dirt from a suction airstream;

a suction source located in one of said upright housing section and said nozzle base section and having a suction airflow inlet in fluid communication with said cyclonic airflow chamber and a suction airflow outlet; and,

a main filter element located in said cyclonic chamber upstream from said suction source for filtering residual dust and dirt from a suction airstream passing through said cyclonic airflow chamber, said main filter element extending upwardly within said cyclonic airflow chamber from a floor of said housing section, wherein a lower portion of said cyclonic airflow chamber is defined by a dirt container for receiving and retaining dirt and dust separated from said suction airstream.

10. The upright vacuum cleaner as set forth in claim 9 further comprising a final filter assembly located on one of said housing and said nozzle base, said final filter assembly being connected in fluid communication with said suction airflow outlet of said suction source for filtering said suction airstream exhausted by said suction source prior to said suction airstream being dispersed into the atmosphere, wherein said final filter assembly comprises a high efficiency particulate arrest (HEPA) filter media.

11. The upright vacuum cleaner as set forth in claim 9 wherein said main filter element comprises porous high-density polyethylene filter media.

12. The upright vacuum cleaner as set forth in claim 11 wherein said porous filter media has pores with an average pore size of less than approximately 90 μm.

13. The upright vacuum cleaner as set forth in claim 11 further comprising an upper conduit depending from a top wall of said upright housing section, wherein said upper conduit includes an outlet passage formed therethrough in fluid communication with a suction airstream outlet of said cyclonic airflow chamber, said main filter element secured in a blocking relation with said outlet passage of said upper conduit so that said suction airstream passes through said main filter element prior to exiting said cyclonic airflow chamber.

14. The upright vacuum cleaner as set forth in claim 13 wherein said upper conduit includes an auxiliary filter positioned in said outlet passage for filtering residual dust and dirt from the suction airstream after the suction airstream passes through said main filter element.

15. The upright vacuum cleaner as set forth in claim 13 wherein an upper end of said main filter element is sealingly engaged with a lower end of said upper conduit.

16. A vacuum cleaner comprising:

a nozzle section;

a housing section connected to said nozzle section and in fluid communication with said nozzle section;

a cyclonic airflow chamber located in said housing section for separating dirt and dust from a suction airstream flowing into said housing section between an inlet located at a periphery of said housing section and an outlet located along a longitudinal centerline of said housing section;

an upper conduit depending from a top wall of said cyclonic airflow chamber and including a passage therein in communication with said outlet of said housing section; and,

a main filter element extending upwardly from a floor of said cyclonic airflow chamber in a central portion of said chamber so that an annulus is defined between said main filter element and the housing portion defining said chamber, said main filter element sealingly engaged with said passage in said upper conduit and adapted for filtering residual dust and dirt from said suction airstream prior to said suction airstream exiting said cyclonic airflow chamber.

17. The vacuum cleaner of claim **16** wherein said housing section comprises a dirt container defining a lower portion of said cyclonic airflow chamber and adapted for receiving and retaining dirt and dust separated from said suction airstream, said container being pivotable between an operative position and an open position and including an open upper end defined by an inclined edge such that when said dirt container is pivoted fully into the open position, the inclined edge is located in a substantially horizontal plane to inhibit spillage of the separated dirt and dust.

18. The vacuum cleaner as set forth in claim **16** further comprising:

a main suction opening located in said nozzle section and connected to a suction airstream inlet of said cyclonic chamber; and,

a suction source located on said housing section, and connected to said outlet thereof, for suctioning an airstream from said nozzle main suction opening into and through said cyclonic chamber to an exhaust outlet of said suction source.

19. The vacuum cleaner as set forth in claim **18** further comprising a final filter chamber connected to said exhaust outlet of said suction source and a final filter element for filtering contaminants from said airstream exhausted by said suction source.

20. The vacuum cleaner as set forth in claim **19** wherein said final filter element comprises high efficiency particulate arrest filter media.

21. The vacuum cleaner as set forth in claim **16** wherein said main filter element comprises high density polyethylene porous filter media having an average pore size of approximately 45 μm to approximately 90 μm.

22. The vacuum cleaner as set forth in claim **16** wherein a portion of said suction airstream in said cyclonic airflow chamber passes through accumulated dust and dirt separated from said suction airstream so that said accumulated dust and dirt acts as a filter media to separate residual dust and dirt from said portion of said suction airstream prior to said portion of said suction airstream passing through said main filter element.

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